Space Weather Technical Forecast

Issued on Saturday, 30 April 2022 at 01:15 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: G1 Minor geomagnetic storm intervals possible in first half of forecast period, but low confidence. Gradually reducing chance of M-class flares (R1/R2 Radio Blackouts). Increased likelihood of Active fluence days 1 and 2.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Moderate with two M1 flares in the past 24 hours. AR2994 is now no longer visible, having rotated to the west limb. However, it produced an M1 flare at 29/1810UTC. In addition, the other M1 flare came from a plage remnant of Ex-2996 in the northwest quadrant at 29/0730 UTC.

There are currently six numbered sunspots on the visible disc, with recently active AR2994 and 2993 now both no longer visible. In addition, the flare-generating plage of Ex-2996, in the northwest quadrant, remains spotless. The numbered sunspots on the visible disc are currently stable and unipolar or simple dipoles, with no notable flares produced from these groups.

A CME associated with the M1 flare at 29/0730 UTC has been modelled, and although the bulk of the ejecta is directed away from the Sun-Earth line, there is a low chance of a passing glance early on 1st May, but this is low confidence. No other Earth-directed CMEs were observed.

Solar Wind / Geomagnetic Activity: The solar wind, as observed by DSCOVR at L1, has been in the range 555-475km/s, with a slow overall erratic decrease. Density stayed within high single figures ppcc. The IMF showed little variation, mainly 6-7nT. The north-south component varied between +4 and -6nT, but was often negative. Resultant geomagnetic activity was Quiet to Active (Kp 2 to 4).

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) was at Background levels, although there was a limited proton response following the M1 flare at 29/0730UTC from ex-2996, with a peak flux of 4,2pfu at 29/2145 UTC.

The high energy electron flux (greater than 2MeV) reached high levels on the diurnal peak, 2960 ppcc at 29/1745 UTC. The associated 24-hour fluence remained below the Active (1e8 integrated pfu) level, but rose sharply, with observed fluence of 7.78e7 integrated pfu at 30/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: There is a daily Slight Chance of further M-class activity, although this is expected to wane during the second half of the forecast period, perhaps significantly so by the very end of the four days as recent active regions successively depart for the far side.

Solar Wind / Geomagnetic Activity: The geomagnetic forecast carries relatively high uncertainty.

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Current modelling suggests the potential glancing pass of a CME which left the Sun around 27/1450UTC early on 30th. A CME from 28 April may also catch up with this first CME to complicate its influence. A further CME associated with the M1 flare at 29/0730 UTC has been modelled, and although the bulk of the ejecta is directed away from the Sun-Earth line, there is a low chance of another passing glance early on 1st May, but this is low confidence.

Otherwise, the current enhanced solar winds, likely from CH78/-, are expected to gradually wane over the next few days.

There is a Slight Chance of G1/Minor Storm (Kp 5) intervals on days one and two (30 April and 1 May), should the potential CMEs pass Earth. Otherwise, geomagnetic activity should gradually taper from occasionally Unsettled conditions to generally Quiet, as coronal hole influence wanes.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is most likely to remain at Background levels through the next four days. However, ex-2996 remains in the northwestern quadrant, and given its recent occasional flare activity remains a potential source for a proton event for the next few days, albeit with probabilities at a slight chance.

The high energy electron flux (greater than 2MeV) may again diurnally peak at high levels over the next couple of days due to coronal hole influence. However, with possible glancing CMEs also in the forecast confidence is low. There is a chance of reaching the Active threshold in the first half of the period, before an expected decrease in the second half of the forecast.

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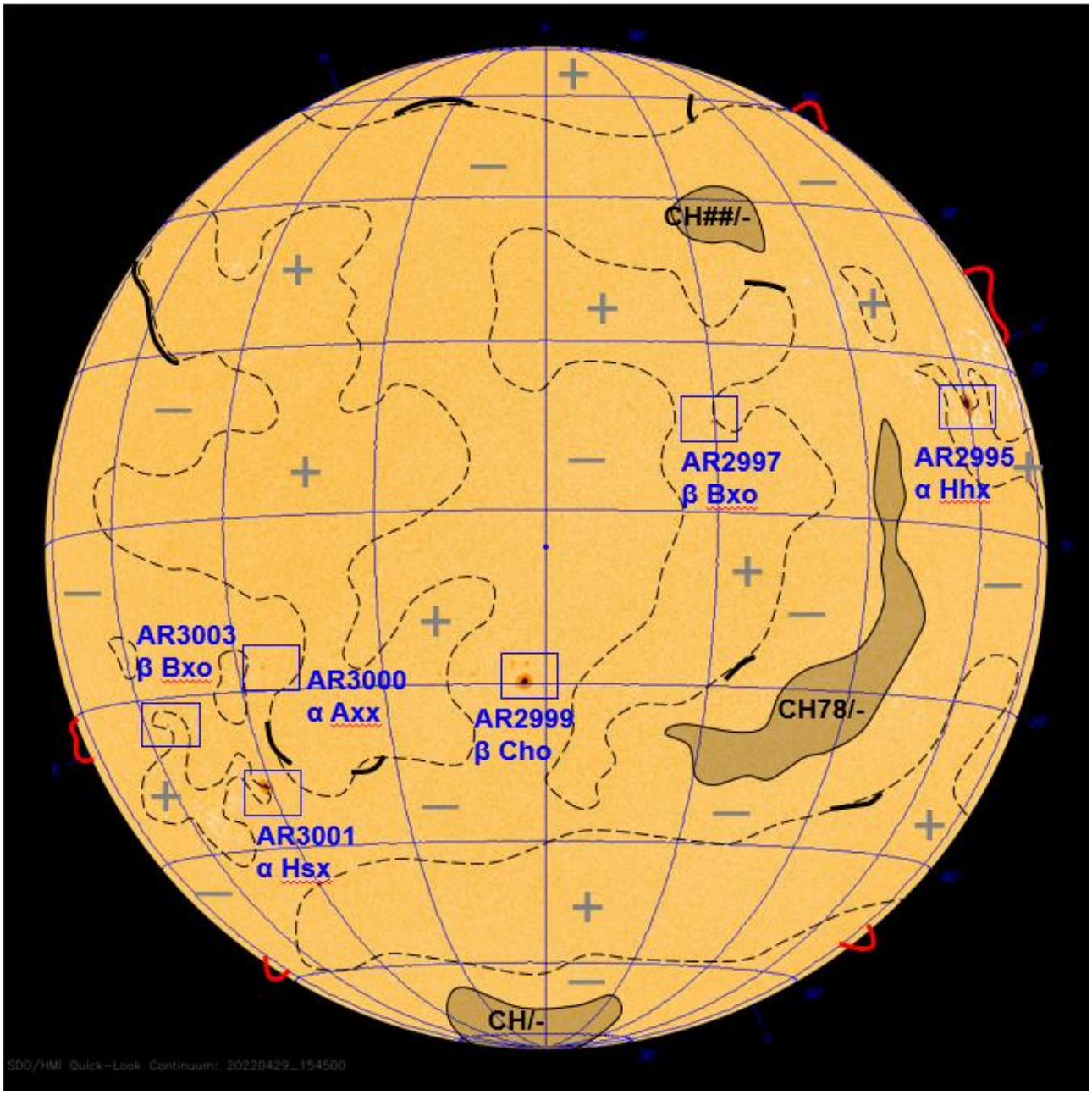
Figure 1. Solar Analysis Valid 29/1600 UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

The geomagnetic forecast carries relatively high uncertainty.
Current modelling suggests the potential glancing pass of a CME which left the Sun around 27/1450UTC early on 30th. A CME from 28 April may also catch up with this first CME to complicate its influence. A further CME associated with the M1 flare at 29/0730 UTC has been modelled, and although the bulk of the ejecta is directed away from the Sun-Earth line, there is a low chance of another passing glance early on 1st May, but this is low confidence.
Otherwise, the current enhanced solar winds, likely from CH78/-, are expected to gradually wane over the next few days.

There is a Slight Chance of G1/Minor Storm (Kp 5) intervals on days one and two (30 April and 1 May), should the potential CMEs pass Earth. Otherwise, geomagnetic activity should gradually taper from occasionally Unsettled conditions to generally Quiet, as coronal hole influence wanes.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	20	20	1	1
Strong	G3	No	1	5	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
27/2138	Partial	C7 flare	NW quadrant	830 km/s	30/0200UTC +/- 6 hrs	Possible glancing blow
29/1228	Partial	M1 flare	NW quadrant	1413km/s	01/0500UTC +/- 6hrs	Low confidence of glancing pass.

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Radio Blackouts - X-Ray Flares:

Solar activity has been Moderate with two M1 flares in the past 24 hours. AR2994 is now no longer visible, having rotated to the west limb. However, it produced an M1 flare at 29/1810UTC. In addition, the other M1 flare came from a plage remnant of Ex-2996 in the northwest quadrant at 29/0730 UTC.

There are currently six numbered sunspots on the visible disc, with recently active AR2994 and 2993 now both no longer visible. In addition, the flare-generating plage of Ex-2996, in the northwest quadrant, remains spotless. The numbered sunspots on the visible disc are currently stable and unipolar or simple dipoles, with no notable flares produced from these groups.
Some bright flux regions towards the east horizon in STEREO A's EUVI 195 imagery are likely to rotate to the eastern horizon of the visible disc toward the end of the period, and will be monitored for potential sunspots.

Through the forecast period a daily Slight Chance of M-class flares is expected but likely with a decreasing trend as ex-2996 rotates westward.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	20	20	10	10
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as measured by GOES-16 at GEO is at background levels, and is most likely to remain so through the next four days. However, a limited proton response followed the M1 flare at 29/0730UTC from ex-2996, with a peak flux of 4,2pfu at 29/2145 UTC.

Although regions 2993 and 2994 have rotated from view at the northwest limb, ex-2996 remains in the northwestern quadrant, and given its recent occasional flare activity remains a potential source for a proton event for the next few days.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	5	5	2	2

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Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

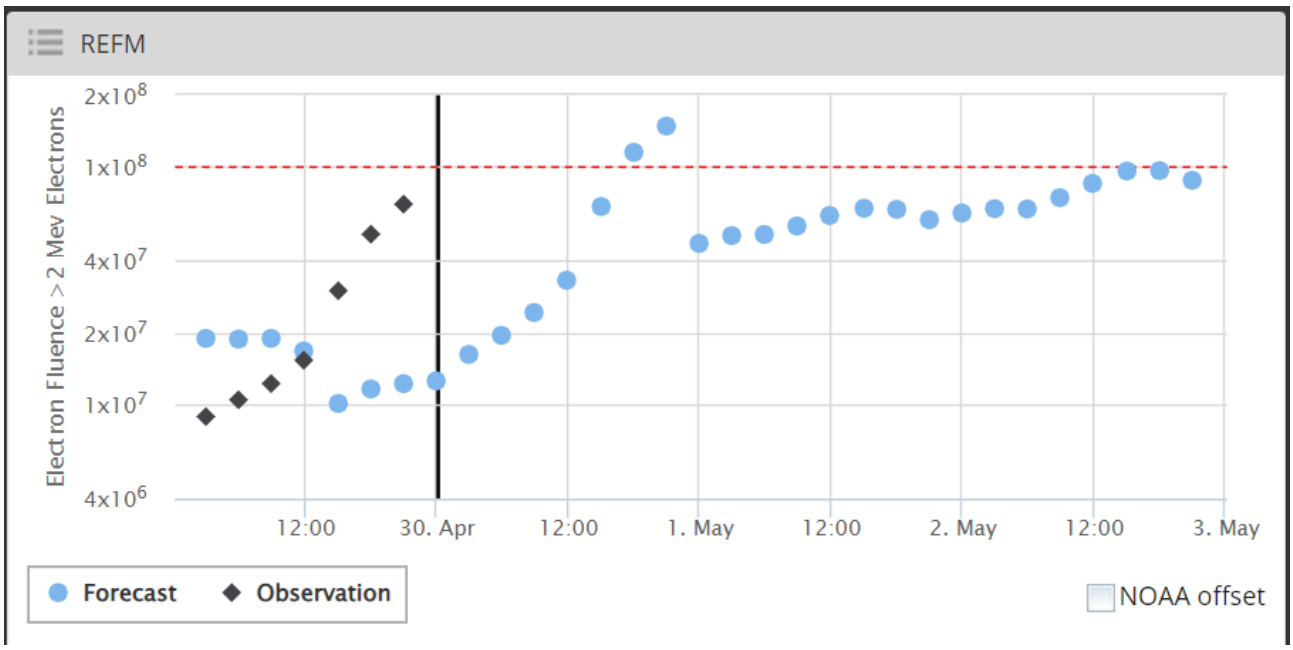
High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2MeV) reached high levels on the diurnal peak, 2960 ppcc at 29/1745 UTC, and may do so again over the next couple of days due to coronal hole influence. However, with possible glancing CMEs also in the forecast confidence is low.

The chance of Active fluence has risen with a likelihood of reaching the Active threshold in the first half of the period, similar to current MOSWOC REFM trends. During the second half of the forecast period fluence levels should gradually decrease again. As mentioned above any potential CME influences may modify these probabilities.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			**(%)**	**(%)**	**(%)**	**(%)**
Active	**≥ 2 MeV ≥ $1x10^8$**	No	60	50	30	20
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 2: MOSWOC REFM



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